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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/592,750	06/13/2000	Kentaro Toyama	149516.1	5780

27662 7590 06/18/2003

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EXAMINER
MILLER, RYAN J

ART UNIT	PAPER NUMBER
2621	7

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/592,750	TOYAMA, KENTARO	
	Examiner	Art Unit	
	Ryan J. Miller	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) *44-47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10,13-22,28,29 and 33-37* is/are rejected.

7)☒ Claim(s) *11-12, 23-27, 30-32, and 38-43* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 June 2000* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5 .
4) ☒ Interview Summary (PTO-413) Paper No(s). 6 .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

   I. Claims 1-43, drawn to a system for tracking at least one object in a scene using a model based on a state estimate of probabilistic configurations and color observations classified in class 382, subclass 103 (target tracking or detecting).

   II. Claims 44-47, drawn to a method for automatically learning a color-based model based on the use of Dirichlet functions classified in class 382, subclass 155 (learning systems).

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because claim 1, the broadest combination claim, does not require the use of a Dirichlet function in order to generate a state estimate or make color observations as required by claim 44, the broadest subcombination claim. The subcombination has separate utility. The method proposed by claim 44, the subcombination claim, can be used in any image processing environment where the use of a model is necessary such as template matching, inspection of manufactured products, or pattern recognition.

3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

4. During a telephone conversation with Mark A. Watson (Reg. No. 41,370) on June 3, 2003 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-43. Affirmation of this election must be made by applicant in replying to this Office action. Claims 44-47 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Objections

5. The following quotation of 37 CFR § 1.75(a) is the basis of objection:

> (a) The specification must conclude with a claim particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention or discovery.

6. Claims 24-27 are objected to under 37 CFR § 1.75(a) as failing to particularly point out and distinctly claim the subject matter which the applicant regards as his invention or discovery.

Claim 24 recites the limitation "second histogram" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 25 recites the limitation "the third histogram" in line 2. There is insufficient antecedent basis for this limitation in the claim.

The examiner assumes that claim 24 depends from claim 23 for examination purposes.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-8, 10, 13-22, 28, 29, and 33-35 are rejected under 35 U.S.C. 102(b) as being anticipated by Birchfield (the article titled "Elliptical Head Tracking Using Intensity Gradients and Color Histograms").

As applied to claim 1, which is representative of claims 15 and 16, Birchfield discloses a system for tracking at least one object in at least one sequential image, comprising: a general purpose computing device; and a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program (see section 5.5: The reference describes that a 200 MHz Pentium Pro microprocessor was used.) to: (a) generate a state estimate defining probabilistic configurations of each object for each sequential image (see section 2: "head's state, i.e. The reference describes estimating a position and size of the head (i.e. an object) in an image (i.e. generate a state estimate) using a vertical ellipse with a fixed aspect ratio of 1.2 (i.e. defining probabilistic configurations of each object for each sequential image).); (b) generate observations of pixel color for each sequential image (see section 4: The reference describes determining a model histogram by counting all of the pixels inside the ellipse and an image histogram.); (c) automatically learn a color-based object model using the state estimate and the observations (see section 2: The reference describes the use of the combination of the intensity gradients around the object's boundary (i.e. state estimate) and the color histogram of the object's interior (i.e. observations) to form a model for tracking the object.); and (d) automatically track each object using the learned color-based model with a color-based tracking function (see section 5.3: The

reference describes that information obtained from the color module and the gradient module (i.e. a color-based model) are used to obtain ideal tracking results.).

As applied to claim 2, Birchfield discloses that generating the state estimate comprises determining the probabilistic configurations of each object using an initial image processing program module (see section 5.5: The reference describes the use of a 200 MHz Pentium Pro microprocessor. This computer has all of the program modules including an initial image processing unit).

As applied to claim 3, Birchfield discloses that the initial image processing program module employs a tracking system comprising a tracking function in combination with an object model for probabilistically detecting object configuration information (see section 2: The reference describes the use of a tracking function (see equation (1)) that makes use of the combination of the intensity gradients around the object's boundary and the color histogram of the object's interior (i.e. an object model) for detecting the object configuration.).

As applied to claim 4, Birchfield discloses that the initial image processing program module employs a contour-based tracking function in combination with a contour-based object model for probabilistically detecting object configuration information (see section 3: The reference describes that the gradient module performs much like a contour-based tracker.).

As applied to claim 5, which is representative of claim 19, Birchfield discloses that generating the observations of pixel color comprises collecting pixel color information over the entirety of each image (see section 4: The reference describes determining a histogram of the entire image (i.e. collecting pixel color information over the entirety of each image).).

As applied to claim 6, Birchfield discloses that generating the observations of pixel color comprises collecting pixel color information over specific portions of each image (see section 4: The reference describes determining a model histogram by counting the pixels inside the ellipse (i.e. collecting pixel color information over specific portions of each image).).

As applied to claim 7, Birchfield discloses generating the observations of pixel color employs the state estimate to identify specific relevant regions of each image over which pixel color information will be collected (see section 4: The reference describes determining a model histogram by counting the pixels inside the ellipse, where the ellipse is the original state estimate as described in section 2 of the reference.).

As applied to claim 8, which is representative of claim 21, Birchfield discloses that generating the observations of pixel color comprises automatically generating a first probability distribution function modeled using a first histogram to represent a range of observed pixel colors (see section 4: The reference describes the use of a histogram for generating color observations of the object. A histogram, as described in the claim, is a probability distribution function.).

As applied to claim 10, which is representative of claim 22, Birchfield discloses program module for automatically learning the color-based object model automatically computes a second probability distribution function modeled using a second histogram to represent a background for each image (see section 4: The reference describes forming an image histogram, which is a histogram of the entire image minus the model (i.e. a background image). Also, as described above, a histogram is a probability distribution function.).

As applied to claim 13, Birchfield discloses that automatically learning the color-based object model comprises performing a bin-by-bin comparison between the first histogram and the second histogram (see section 4: The equation for determining Φ_c performs a bin-by-bin comparison between the model histogram (i.e. the first histogram) and the image histogram (i.e. the second histogram).).

As applied to claim 14, Birchfield discloses that bins in the first histogram having values exceeding corresponding bins in the second histogram correspond to those color ranges representing the learned color-based object model (see section 4: The reference describes that the equation for determining Φ_c is used, in part, to represent the color-based object model.).

As applied to claim 17, Birchfield discloses that a confidence measure is associated with the observations of pixel color (see section 4: The reference describes that an offline, as well as an online, histogram is obtained. The offline histogram is used as a confidence measure that the online histogram (i.e. observations of pixel color) is actually a histogram representation of the head.).

As applied to claim 18, Birchfield discloses that the observations of pixel color are weighted in proportion to the confidence measure (see section 4: The equation Φ_c is used to weight the online histogram (i.e. observations of pixel color) by the values of the offline histogram (i.e. the confidence measure).).

As applied to claim 20, Birchfield discloses that the observations of pixel color are collected over specific portions of each image wherein the state estimate has a probability greater than a minimum threshold level (see section 4: The reference describes determining a model histogram by counting the pixels inside the ellipse (i.e. collecting pixel color information over

specific portions of each image). The ellipse corresponds to the state estimate. Therefore, an ellipse will only be formed if the state estimate exists, so the state estimate has to have a probability greater than zero (i.e. a minimum threshold level).).

As applied to claim 28, Birchfield discloses that generating the state estimate comprises processing each image with an initial object model and an initial tracking function (see section 2: The reference describes modeling the head as an ellipse (i.e. initial object model) and the use of equation (1) (i.e. an initial tracking function).).

As applied to claim 29, Birchfield discloses that the initial object model is iteratively replaced with the learned color-based object model and the initial tracking function is replaced with a color-based tracking function to improve the accuracy of the learned color-based object model (see section 2: Equation (1) is constantly updated based on the values obtained from the gradient module and the color module.).

As applied to claim 33, Birchfield discloses a process for gathering the sequential images (see section 1: The reference describes that the system can be implemented in various applications such as video conferencing, where a video camera would be used to gather the sequential images.).

As applied to claim 34, Birchfield discloses a computer-readable memory for identifying the configuration of objects of interest in a scene, comprising: a computer-readable storage medium; and a computer program comprising program modules stored in the storage medium, wherein the storage medium is so configured by the computer program that it causes the computer to: generate an initial configuration estimate for objects of interest within the scene (see section 2: The reference describes estimating a position and size of the head (i.e. an object)

in an image (i.e. generate an initial configuration estimate) using a vertical ellipse.); identify pixel color information within the scene that is relevant to a learned color-based object model (see section 4: The reference describes determining a model histogram by counting all of the pixels inside the ellipse and an image histogram.); automatically learn the color-based object model by determining probabilistic relationships between the initial configuration estimates and the pixel color information (see section 2: The reference describes the use of the combination of the intensity gradients around the object's boundary (i.e. initial configuration estimates) and the color histogram of the object's interior (i.e. pixel color information) to form a model. This combination is a probabilistic relationship since the area where the pixel color information is obtained from is based on the initial configuration estimates.); and generate a final configuration estimate for objects of interest in the scene by using the color-based object model in combination with a color-based tracking function (see section 2: Equation (1) is used to determine a final configuration estimate for the objects in the scene.).

As applied to claim 35, Birchfield discloses that the program module for generating the initial configuration estimate further includes an initial object model and an initial tracking function, and wherein the initial object model is comprised of parameters used by the initial tracking function for determining the configuration of objects within the scene (see section 2: The reference describes modeling the head as an ellipse (i.e. initial object model) and the use of equation (1) (i.e. an initial tracking function).).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 9, 36, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Birchfield (the article titled "Elliptical Head Tracking Using Intensity Gradients and Color Histograms") and Koller et al. (the article titled "Using learning for approximation in stochastic processes"). The arguments as to the relevance of Birchfield in the rejections of claims 1, 8, 34, and 35 are incorporated herein.

As applied to claims 36 and 37, Birchfield discloses representing the pixel color information and the background image information using a probability distribution function (see section 4: The reference describes using a histogram (i.e. a probability distribution function) to represent the model (i.e. pixel color information) and the image (i.e. background information).

Claim 9, as well as claims 36 and 37, call for the use of a Dirichlet function. Birchfield does not teach the use of a Dirichlet function; however, Koller et al., in the same field of endeavor of image processing, and the same problem solving area of object tracking, describes the use of such a function (see column 10: The reference describes the use of a Dirichlet prior for use with a multinomial distribution.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Birchfield by adding the use of a Dirichlet function as taught by Koller et al. because the use of a Dirichlet function "serves to 'spread out' some of the probability mass over unobserved states, increasing the amount of exploration done for unfamiliar regions of the space" (see Koller et al.: column 11).

Allowable Subject Matter

11. Claims 11, 12, 23, 30-32, and 38-43 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. Claims 24-27 are also objected to as being dependent upon a rejected base claim, but would be allowable if rewritten to correct for the 37 CFR § 1.75(a) objection described above and in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Marks et al. (U.S. Patent No. 5,845,009 A) is pertinent in that the reference teaches a method of identifying and tracking an object in an image using statistical models based on color and shape.

Toyama et al. (U.S. Patent No. 6,502,082 B1) is pertinent in that the reference teaches the use of a statistical model in tracking an object based on various tracking modalities.

Cosatto et al. (U.S. Patent No. 5,864,630 A) is pertinent in that the reference discloses a tracking system that uses color and shape information.

Darrell et al. (U.S. Patent No. 6,445,810 B2) is pertinent in that the reference discloses a method for tracking an object using color segmentation and pattern classification.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ryan J. Miller whose telephone number is (703) 306-4142. The examiner can normally be reached on M-F 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Boudreau can be reached on (703) 305-4706. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4750.

Ryan J. Miller
Examiner
Art Unit 2621

Ryan J. Miller
June 13, 2003

BRIAN WERNER
PRIMARY EXAMINER